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STUDIES OF MEAN PERFORMANCE TO IDENTIFY SUPERIOR GERMPLASM LINES OF LINSEED (*Linum usitatissimum* L.)

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ABSTRACT

Four hundred forty germplasm lines of linseed alongwith three checks were conducted at Main Experimental Station, NDUA&T, Kumarganj, Faizabad. In this study, out of 440 germplasm, only thirty germplasm were screened on the basis of their mean performance for seed yield per plant. Variance due to block were significant for number of secondary branched per plant only, while variance due to checks was highly significant for all the characters except PDI (AB) on leaves and number of seeds per capsule. Maximum variability was estimated in number of capsules per plant. The values of least significant differences (LSD's) for different characters, the LSD^1 were greater than LSD^2 and lower than LSD^3. Germplasm lines CI-1183 (15.11), A-225 B (94.21), A-95 B (12.34), A-223 A (144.90), A-95 B (159.05), A-95 B(10.28) and A-399B (89.33) were recorded highly significant with high mean value for yield per plant, plant hight, number of primary branched per plant, number of secondary branched per plant, number of capsules per plant, number of seeds per capsule and 1000 seed weight, respectively. The genotypes of highly significant along with low value of per se performance recorded in A-44 (76.09), CI-1427 (121.65) and A-37 A (12.66) for days to flowering, days to marketable maturity and PDI (AB) on leaves, respectively. These germplasm lines may be used successfully in breeding programme for b to developed high yielding varieties in linseed.

KEYWORDS: Linseed, Variances, Mean Performance, Yield

Linseed (*Linum usitatissimum* L., 2n=30) is one of the most oil seed crop, belonging to Family Linaceae and, includes 14 genera and 200 species. It is native to the Mediterranian region. Flax is one of the oldest plant species cultivate for oil fibres (Ley and Dybing, 1989). The genus linseed has both cultivated and wild species. The wild species have very little economic values. Almost all species are annual herbs, while some are shrubs. Linum is only species with no-dehiscent or semi-dehiscent capsules suitable for cultivation (Getinet and Dybing, 1997). Brutch, *et al.* (2001) reported that white petal colour is rare in indigenous germplasm and also observed to petal size, shape and colour in linseed. Mozkova *et al.* (2006) observed greater variability for petal colour. Linseed is mostly self-pollinated crops, but cross-pollination occurs up to 2% due to insect's activities (Dillman, 1928). Until the 1990's, flax plant was primarily used to make textiles and paper, while flaxseeds oil and its by-products were used to make animal feed (Singh *et al.* 2011). Flaxseed are rich in nutrients and contain many types of fatty acid such as α-linolenic acid, short chain unsaturated fatty acid, soluble and insoluble fibres, phytoestrogenic lignans, proteins and an array of antioxidants (Ivonova *et al.,* 2011 and singh *et al.,* 2011). Selection is an essential part of breeding programme to develop superior genotypes and its play the kyes role in the development of high yielding varieties with the changed environment. However, selection for high yielding cultivars is difficult due to its complex nature. Yield per unit area is the end-product of components of several characters that are polygenic in inheritance and highly influenced by environmental fluctuation. Hence, the present study was taken with an objective to know the selection of high value of mean performance in the linseed germplasm to implement in the breeding programme.

MATERIALS AND METHODS

The experimental material was conducted at main Experimental Station of N.D. Uni. of Agri. And Tech., Kumarganj, Faizabad. The materials for present study collected from P.C. Unit Linseed, (ICAR), C.S.A. University of Agriculture and Technology, Kanpur. Four hundred forty germplasm lines were planted in Augmented Block Design with three checks (Neelam, T 3397 and Kiran). The checks varieties were distributed systematically in every blocks. All the recommended cultural practices were followed to raise a good crop. The data were recorded from five randomly selected plants, while the days to 50% flowering, days to maturity and percent disease intensity of Alternaria blight (PDI-AB) on leaves which were recorded on line basis. The remaining characters such as plant height (cm) (PH), number of primary branches per plant (PB/P), number of secondary branches per plant (SB/P), number of capsules per plant (C/P), number of seeds per capsule (S/P), 1000 seed weight (SW) and seed yield per plant (SY/P) were recorded on the basis of ten randomly selected plants. Alternaria blight disease reactions were recorded on five plants selected randomly from each germplasm lines at the severity stage on leaves (middle, bottom and top). The following 0 to 5 scale suggested in the proceeding of AICRP on linseed pathology planning (review session 1997-98) were recorded. The statistical analysis suggested by Federer (1956) was used to estimate the mean values.

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RESULTS AND DISCUSSION

The analysis of variances for the experimental design involving 440 linseed germplasm and three checks for all the characters are presented in the Table 1. Only number of branches per plant observed significant variances due to blocks, while the variances due to checks was have highly significant for all the characters except number of capsules per plant under study. The mean and variance in respect of various characters are present in Table 2. The values of of least significant differences (LSD's) for different characters for comparing the differences between two adjusted means of the same block "two test line (LSD^1)" were greater than LSD's computed for comparing the differences between adjusted mean of "test lines and of checks (LSD^2)" and lower than that of "two entries in different block (LSD^3)". Out of 440 germplasm lines, only twenty-five entries were identified as highly significant with desirable mean value as compare to checks for different characters and it present in Table 3.

Table 1: Analysis of variance of checks for ten characters in linseed

Sources of variation	D.F.	Mean square									
		DF	DM	PDI (AB)	PH	PB/P	SB/P	C/P	S/C	Y/P	SW
Blocks	10	8.24	4.81	91.65	22.06	0.58	158.45**	57.86	1.35	0.76	0.09
Checks	2	178.84**	64.33**	208.10**	2229.06**	4.42**	472.33**	824.42**	0.24	38.40**	40.40**
Error	20	12.66	7.88	71.06	10.35	0.62	8.99	87.84	0.77	0.63	0.94
Total	32										

*Significant at 5% probability level, **Significant at 1% probability level

The genotype CI-1183 (15.11) was identified with significantly greater yield per plant Followed by A-225 B (14.53), CI-15 B (14.31) and A-376 (14.20). The germplasm line A-474 was significantly earliest followed by A-469B, 477-3/2 and A- 491. The entries A-401 (116.15), A-399B (116.65), 162-OR-3-1 (121.65) and CI-1597 (121.82) and 11x14 (122.65) were recorded as significantly earliest germplasm lines. The significantly lowest PDI of Alternaria blight on leaves than checks were observed in the genotypes such as A-225B (12.66%), A-75 (21.50%), A-226 (22.34%), A-364 (22.54) A-232 (23.66%) and A-66 (24.25%) which has the moderately resistant to disease Alternaria blight out of 440 germplasm lines.

Table 2: Mean and Coefficient of variation for different characters of 440 linseed germplasm (pooled analysis)

Characters	Range of parameters							
	Mean	Coefficient of variation (%)	LSD^1		LSD^2		LSD^3	
			Same block		Adjusted means of check mean		Different block	
			5%	1%	5%	1%	5%	1%
DF	95.88	3.71	10.50	14.31	8.95	12.21	12.12	16.53
DM	130.10	2.16	8.28	11.29	7.06	9.63	9.56	13.04
PDI (AB)	61.31	13.75	24.87	33.92	21.21	28.93	28.72	39.16
PH	60.36	5.33	9.49	12.95	8.09	11.04	10.96	14.95
PB/P	3.42	12.95	2.32	8.16	1.98	2.69	2.67	3.65
SB/P	8.38	15.78	8.84	12.06	7.54	10.29	10.21	13.93
C/P	29.73	21.53	27.65	37.71	23.58	32.16	31.93	43.54
S/C	7.71	11.40	2.59	3.54	2.21	3.02	2.99	4.08
Y/P	5.06	15.74	2.35	3.20	2.00	2.73	2.71	3.70
SW	5.72	5.36	0.90	1.23	0.77	1.05	1.04	1.42

Where,

LSD_1 = For comparing the differences between two adjusted means of the two tests lines in the same block

LSD^2 = For comparing the differences between adjusted means of two tests lines and of block

LSD^3 = For comparing the differences between two adjusted means of the two entries in different block

Table 3: Means for 25 best significant superior lines selected for ten matric traits out of 440 linseed germplasm

S.N	SY/P**		DF*		DM*		PDI (AB)*		PH**		PB/P**		SB/P**		C/P**		S/C**		TW**	
1	Germ plasm	Mean	Germ plasm	Mean	Germ plasm	Mean	Germ plasm	Mean	Germ plasm	Mean	Germ plasm	Mean	Germ plasm	Mean	Germ plasm	Mean	Germ plasm	Mean	Germ plasm	Mean
2	3/1	10.58	164/1	79.26	9 X7	125.65	9X17	31.37	1,76	88.25	69/1	6.31	9X12	22.25	5/37-2/1-61/1	65.17	A-44	10.08	39,1	7.74
3	5/37-2/1-61/1	12.16	A-371	77.92	11 X 12	124.15	A-6-1-5	31.15	3X1	88.4	4602	7.91	9-JBP-1986	17.98	68-IC-32676	64.32	A-47	9.58	448-5	8.26
4	5/47-2/1-10/10	11.50	A-373	77.92	11 X 14	122.65	A-44	30.01	Ajnar-20 M	78.47	A-376	6.58	Bikaopur Local	17.01	149T-126-1	60.22	A-56	10.08	A-15-1-2	7.83
5	9 x 17	12.78	A-374	77.92	23 X 3	125.65	A-184	25.46	A-71	76.65	A-378	5.97	1636	18.73	A-58	74.62	A-59	9.93	A-97	7.62
6	12x15	11.53	A-375	79.92	63,4-34	125.65	A-69	27.01	A-72	79.7	A-382	5.73	A-10-2-2	20.51	A-60	70.72	A-60	9.88	A-105	8.17
7	CI-1427	13.05	A-378	79.92	162-OR-3-1	121.65	A-70	32.01	A-95	76.5	A-415	6.16	A-12-1-2	18.26	A-382	90.98	A-62	10.03	A-388	8.13
8	A-44	13.31	A-469B	76.09	191-RR-9	124.65	A75	21.50	A-95 B	80.5	Baulk-160	6.27	A-164	18.07	CI-1383	87.15	A-65	9.63	A-180	8.64
9	CI-1413	13.09	477-3/2	76.42	164/1	124.65	A-89	35.37	A-6-1-5	77.5	Bengal-18	6.36	CI-1427	31.76	CI-1399	67.01	A-70	9.93	A-196	7.94
10	CI-1466	13.53	A-491	76.92	CI-1596	124.32	A-364	22.54	A-19-6	80.01	Bengal-36	5.74	CI-1459	31.73	A-364	65.35	A-71	9.98	A-305	8.64
11	A-60	12.34	BR-2	79.76	191xRR-9/2	125.65	A-366	30.29	A-40	77.31	CI-1169	6.23	CI-1466	21.76	CI-1413	108.65	A-75	10.03	A-308	8.49
12	A-69	12.12	BR-3	78.76	477-3/2	124.49	A-371	36.54	A-58	76.51	CI-1183	7.59	CI-1888	83.79	CI-1419	86.05	A-76	9.63	A-310	7.59
13	A-95 B	10.16	BR-5	78.76	A-418	125.65	A-373	27.41	CI-1538	82.53	CI-1383	12.34	Bangal-18	27.35	CI-1427	159.05	A-77	10.28	1541	7.64
14	A-141	10.21	BR-8	78.76	A-429 B	125.65	A-226	22.34	A-171	79.29	CI-1399	8.17	CI-1169	20.92	A-1459	141.31	A-79	9.58	A-373	7.84
15	A-164	11.84	BR-9	78.76	A-439	125.15	A-232	23.66	A-184	76.68	A-225	5.78	CI-1183	22.76	CI-1466	65.35	A-92	9.98	A-389B	7.72
16	CI-15 B	14.31	BS-25 B	79.26	A-441	125.15	A-310	30.16	A-202	87.88	A-238	6.01	CI-1383	37.91	CI-1402	144.95	A-95B	9.93	477-3/2	7.54
17	A-184	11.48	CI-1560	79.59	A-444	125.15	A-313	26.56	A-207	85.48	CI-1466	6.19	CI-1552	50.15	16XRR-9	67.82	A-98	9.88	A-381	8.88
18	A-223A	11.16	CI-1561	79.09	A-447	125.15	A-66	24.25	A-382	81.71	CI-15 B	6.38	CI-1402	144.9	9X17	61.27	A-396A	9.78	A-386	8.27
19	A-225	12.09	CI-1566	78.59	A-469 B	125.48	BAU-175-4	32.97	Ajgan-14	77.77	CI-1412	6.18	CI-1412	21.96	A-376	62.35	A-459	9.63	BAU-152	8.59
20	A-225B	14.53	CI-1568	79.59	491	123.98	A-202	25.54	A-69	94.21	CI-1413	6.84	CI-1419	21.11	A-225	82.31	Baulk-160	9.89	BAU-191	8.51
21	A-364	13.28	A-474	75.59	CI-1597	121.82	A-223A	36.41	Alepur	79.47	CI-1419	6.97	CI-1399	23.74	A-164	63.41	CI-1568	9.96	Baulk-160	7.51
22	A-373	10.58	BR-29	79.26	A-399 A	125.65	A-225	34.54	Amara	77.27	CI-1427	10.21	11x12	18.91	A-225 B9	96.71	C-429-3	9.81	BR-2	7.64
23	A-374	11.35	CI-1569	80.56	A-399 B	116.65	A-225B	12.66	Army	81.27	CI-1459	8.21	CI-1672	45.32	A-223 A	68.35	CI-1581	9.76	491	9.33
24	A-376	14.20	CI-1574	80.59	A-401	116.15	CI-1892	29.91	CI-244	81.38	CI-1693	6.17	CI-1900	38.47	A-223B	94.11	CI-1583	9.81	Balwani	8.71
25	CI-1183	15.11	BR-1	80.26	A-411	125.15	BR-20	30.54	CI-540	78.08	CI-1888	6.94	CI-1413	108.6	A--376	62.35	CI-1894	9.96	A-382	9.23
26	CI-1402	12.99	CI-1622	80.09	B-81-81	125.48	BR-28	30.47	CI-763	80.53	CI-1402	11.99	A-386	17.71	A-164	63.41	CI-169	9.76	1636	7.69
27	Check mean	6.45	-	95.48	-	131.52	-	50.49	-	66.80	-	3.54	-	21.38	-	38.65	-	7.33	-	6.77
28	Lowest	9.01	-	76.09	-	116.65	-	12.66	-	50.71	-	1.93	-	8.03	-	19.80	-	5.20	-	4.23
29	Highest	15.11	-	109.0	-	137.50	-	65.13	-	94.21	-	12.34	-	144.9	-	159.05	-	10.28	-	9.33
30	Critical difference	0.71	-	3.165	-	2.50	-	7.50	-	2.86	-	0.70	-	2.67	-	8.34	-	0.18	-	0.27

*Taken to low mean values **Taken to high mean values

The genotypes A-69, 3x1,1/76, A-202 and A-207 were identified as the tallest and significant superior lines for plant height and their mean values 94.21, 88.40, 88.25, 87.88 and 85.48 cm, respectively. The significantly higher number of primary branched per plant than checks were recorded in genotypes CI-1383 (12.34), CI-1402 (11.99), CI-1427 (10.21), CI-1459 (8.21) and CI-1399 (8.17). The genotype CI-1402 had the highest number of secondary branches per plant (144.99) followed by CI-1888 (83.79), CI-1552 (50.15) and CI-1672 (45.32).

The most important yield contributing character Such as number of capsules per plant was significantly higher in the genotypes CI-1427 (159.05), C-1402 (144.95), A-1459 (141.31) and CI-1413 (108.65) which has undoubtedly high value of per se performance than others genotypes. The highest number of capsules per plant 10.28 was observed in A-77 followed by A-44 (10.08), A-56 (10.08), A-62 (10.03) and A-75 (10.03). The genotype 491 was recorded 9.33g with significantly greater 1000-seed weight than checks followed by A-382 (923g), A-381 (8.88g), Balvani (8.71g), A-305 (8.64g) and A-180 (8.64g). Accordingly results advocated by Negi and kinga (1959), Reddy, *et al.* (1982), Chauhan and Srivastava (1975), Mahto and Singh (1996), Mozkova *et al.* (2006) and Tadesse *et al.* (2010).

CONCLUSION

The present study of four hundred forty germplasm lines was collected over the country. In these germplasm lines were present vast variability. Therefore, it plays a very important role to identify superior germplasm lines on the basis of there mean performance. Undoubtedly, most of the germplasm has the highest significant results along with high mean values. Overall, twenty-five germplasm entries out of four hundred forty were recorded as a highest per se performance for ten matric traits than remaining germplasm lines. These valuable genotypes may be immense useful for breeders to utilized as parents for development of hybrids in linseed through hybridization programme.

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